Docket No.: ASU-0003 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

EXPEDITED PROCEDURE UNDER 37 C.F.R. §1.116

Susan Davis Allen

Serial No.: 09/909,993

Group Art Unit: 1378

Confirmation No.: 1378

Examiner: G. Winter

Filed: July 23, 2001

Customer No.: 34610

For: METHOD AND APPARATUS FOR REMOVING MINUTE PARTICLES FROM A SURFACE

REQUEST FOR RECONSIDERATION

U.S. Patent and Trademark Office
220 20th St. S.
Customer Window, **Mail Stop AF**
Crystal Plaza Two, Lobby, Room 1B03
Arlington, VA 22202

Sir:

In reply to the Final Office Action dated May 4, 2004, the date for reply having been extended two months by a Petition for Extension of Time filed herewith, reconsideration of the rejections set forth therein is requested as follows:

Claims 1-15, 17-37, and 66 are pending. The Examiner has withdrawn from consideration claims 4-7, 12-13, 19, and 21.

The Office Action again rejected claims 1-3, 6, 8-11, 14-18, 20 and 22-37, and newly rejected claim 66 under 35 U.S.C. §102(b) as being anticipated by the Tam reference. The rejection is respectfully traversed.

As previously discussed, the Tam reference is a general research paper from 1991 that looks at general laser cleaning techniques for removal of surface particulates. The Tam reference first examines dry laser cleaning and then examines steam laser cleaning, comparing the efficiency of the two cleaning techniques. In the steam laser cleaning section, the Tam reference examines particle removal using strong substrate absorption, strong liquid-film absorption, which Tam dismisses as less effective than strong substrate absorption, and partial absorption by substrate and liquid film. In each case, the Tam reference discusses <u>a single example</u> in which a <u>uniform 1 μm thick</u> layer of mainly <u>water</u> was utilized. See pages 3518-3520 of the Tam reference. In fact, the Tam reference at page 3522 admits that "[m]ost of our work done so far is performed with a liquid film composed of distilled water mixed with 10%-20% methanol, isopropanol, or ethanol." Further, the Tam reference concludes at page 3522 that "[q]uantitative understanding of the role played by the type and thickness of the liquid used is *yet to come*" (emphasis added). Thus, the Tam reference does not address selecting a composition, thickness, and geometry of an energy transfer medium based on a composition of the one or more particle(s) to be removed and a composition of the substrate.

In contrast, Applicant has discovered, as evidenced in the present application, that by selecting laser energy transfer parameters and a <u>composition</u>, <u>thickness</u>, <u>and</u> <u>geometry</u> of an energy transfer medium <u>based on a composition of the one or more particle(s) to be removed and a composition of the substrate</u>, the energy deposition into at least the energy transfer medium can be controlled so as to remove the one or more particle(s) from the surface while

minimizing damage to the substrate. Selecting the composition of energy transfer medium includes, for example, selecting the components of the energy transfer medium to produce desired optical, chemical and thermophysical properties. Selecting the thickness of the energy transfer medium includes, for example, selecting the amount of energy transfer medium deposited on the particle/substrate system. Selecting the geometry of the energy transfer medium includes, for example, selecting the form of the energy transfer medium upon deposition on the substrate such as a uniform thickness layer, a droplet surrounding the particle(s), and/or absorption of the energy transfer medium into the capillary spaces under the particle(s). As discussed above, the Tam reference does not address and thus fails to disclose or suggest selecting a composition, thickness, and geometry of an energy transfer medium based on a composition of the one or more particle(s) to be removed and a composition of the substrate. Further, the Tam reference fails to disclose or suggest selecting laser energy transfer parameters and a composition, thickness, and geometry of an energy transfer medium based on a composition of the one or more particle(s) to be removed and a composition of the substrate to control the energy deposition into at least the energy transfer medium to effect removal of the one or more particle(s) from the surface while minimizing damage to the substrate.

The Examiner argues in the "Response to Remarks" section on page 2 of the Office Action that "the added claim limitations are present in Tam, thickness and geometry are present in all energy transfer mediums." However, as discussed above, the Tam reference does not address and thus fails to disclose or suggest selecting a composition, thickness, and geometry of

an energy transfer medium based on a composition of the one or more particle(s) to be removed and a composition of the substrate. Further, claim 1, for example, recites "selecting laser energy parameters and a composition, thickness, and geometry of an energy transfer medium <u>based on a composition of the one or more particle(s) to be removed and a composition of the substrate</u>" and further recites "wherein said laser energy transfer parameters and said composition, thickness, and geometry of the energy transfer medium are selected to control energy deposition into at least the energy transfer medium to effect removal of the one or more particle(s) from the surface while minimizing damage to the substrate." While it is true that thickness and geometry are present in all energy transfer mediums, Tam does not disclose or suggest selecting the composition, thickness, and geometry of an energy transfer medium <u>based on a composition of one or more particles to be removed and a composition of the substrate</u>. Rather, in each case disclosed by Tam only a single example of energy transfer medium, a uniform 1 micrometer thick layer of mainly water, was utilized. There is no discussion or suggestion of selecting the composition, thickness, and geometry of this layer <u>based on a composition of particles to be removed and a composition of the substrate</u>. As set forth above, the Tam references specifically acknowledges at page 3522 that "[q]uantitative understanding of the role played by the type and thickness of the liquid used is *yet to come*" (emphasis added).

The Examiner further argues that minimizing damage to the substrate is vague. However, it is respectfully submitted that one of ordinary skill in the art would understand or

recognize what it means to minimize damage to a substrate, as reducing damage to the substrate in comparison with prior art methodologies.

Thus, with respect to independent claim 1, the Tam reference at least fails to disclose or suggest selecting laser energy transfer parameters and a composition, thickness, and geometry of an energy transfer medium based on a composition of the one or more particle(s) to be removed and the composition of the substrate, wherein the laser energy transfer parameters and the composition, thickness, and geometry of the energy transfer medium are selected to control energy deposition into at least the energy transfer medium to effect removal of the one or more particle(s) from the surface while minimizing damage to the substrate, or the combination thereof.

With respect to independent claim 33, the Tam reference at least fails to disclose or suggest adsorbing an energy transfer medium under and around the one or more particle(s) to be removed, wherein a composition, thickness, and geometry of the energy transfer medium are selected based on a composition of the one or more particle(s) to be removed and a composition of the substrate, selecting one or more of the laser wavelength of the laser energy, the length and shape of the laser pulse, the density of the laser energy, the pulse repetition rate of the laser energy, the laser beam size and/or shape, the irradiation geometry, and the ambient conditions, and a composition, thickness, and geometry of the energy transfer medium, to precisely control an energy deposition into at least the energy transfer medium, and absorbing sufficient laser

energy in at least the energy transfer medium to dislodge the one or more particle(s) from the surface while minimizing damage to the substrate, or the combination thereof.

With respect to independent claim 35, the Tam reference at least fails to disclose or suggest determining a tailored composition with a tailored thickness and geometry to serve as an energy transfer medium for the optical radiation source having the optical energy distribution, and determining a tailored optical pulse of the optical radiation source in view of the composition, thickness, and geometry of the energy transfer medium, a surface of a sample, a sample and/or one or more particle(s) to be removed from a sample, such that when the energy transfer medium is arranged on the surface of the sample having the one or more particle(s) and is subsequently irradiated by the optical radiation source, sufficient energy is transferred from the tailored optical pulse to the one or more particle(s) via the energy transfer medium to dislodge said one or more particle(s) from the surface while minimizing damage to the sample, or the combination thereof.

With respect to independent claim 36, the Tam reference at least fails to disclose or suggest tailoring a composition, thickness, and geometry of an energy transfer medium in view of optical properties of the sample and the optical energy distribution, determining a tailored pulse in view of the composition, thickness, and geometry of the energy transfer medium, the optical energy distribution, the surface, the sample and/or the one or more particle(s) to be removed from the sample, and irradiating at least the energy transfer medium with the tailored

pulse thereby dislodging the one or more particle(s) from the surface while minimizing damage to the sample, or the combination thereof.

With respect to independent claim 37, the Tam reference at least fails to disclose or suggest arranging an energy transfer medium having a predetermined composition, thickness, and geometry on a surface of a sample, and irradiating the energy transfer medium with an optical radiation pulse tailored to the one or more particle(s), the sample, and the energy transfer medium such that energy from the tailored optical radiation pulse is absorbed largely by the energy transfer medium but not significantly by the sample causing the one or more particle(s) to be removed from the surface while minimizing damage to the sample, or the combination thereof.

With respect to independent claim 66, the Tam reference at least fails to disclose or suggest selecting laser energy transfer parameters and a composition, thickness, and geometry of the energy transfer medium based on the particle(s)/substrate combination, determining laser energy transfer parameters based on said particle(s)/substrate/energy transfer medium combination to yield controlled energy deposition into at least said energy transfer medium, and irradiating at least said energy transfer medium with said laser energy having said selected laser energy transfer parameters to effect controlled deposition into at least said energy transfer medium, wherein said controlled energy deposition removes the one or more particle(s) from the surface while minimizing damage to the substrate.

Accordingly, the rejection of independent claims 1, 33, 35, 36, 37 and 66 should be withdrawn. Dependent claims 2-15, 17-31, and 34 are allowable at least for the reasons discussed above with respect to independent claims 1 and 33, from which they respectively depend, as well as for their added features.

The Office Action rejected claim 32 under 35 U.S.C. §103(a) as being unpatentable over the Tam reference in view of Doyel et al. (hereinafter "Doyel"), U.S. Patent No. 6,130,195. The rejection is respectfully traversed.

Doyel fails to overcome the deficiencies of the Tam reference discussed above with respect to independent claim 1, from which claim 32 ultimately depends, as Doyel is merely cited as allegedly teaching the interchangeability of ethanol, methanol, isopropanol and benzyl alcohol. Accordingly, dependent claim 32 is allowable for the reasons discussed above with respect to independent claim 1, from which it ultimately depends as well as for its added features.

In view of the foregoing amendments and remarks, it is respectfully submitted that the application is in condition for allowance. If the Examiner believes that any additional changes would place the application in better condition for allowance, the Examiner is invited to contact the undersigned attorney, **Carol L. Druzbick**, at the telephone number listed below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this, concurrent and future replies, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,
FLESHNER & KIM, LLP

Carol L. Druzbick
Registration No. 40,287

P.O. Box 221200
Chantilly, Virginia 20153-1200
703 766-3701 CLD/kah
Date: October 4, 2004

Please direct all correspondence to Customer Number 34610